Carbon dioxid and climate change

Elena Karaganova
Donetsk National Technical University, Ukraine

A change of climate resulting from an increase in the atmospheric carbon dioxide concentration may bring increased drought to the interior of continents and increased precipitation to many other regions.

The Earth's surface and atmosphere maintain a balance between the incoming flux of solar radiation and the outgoing infrared radiation balance the mean surface temperature of the Earth is about 15 ˚C. Disturb this balance and the temperature may up and down. Increased amounts of carbon dioxide and water vapor can cause warming of the global climate. Climatologists are carefully considering this phenomenon in their calculations of change by using large-scale, numerical, computerized climate models. They find that a doubling of the atmospheric concentration of carbon dioxide could produce an increase of the global mean temperature of the Earth of about 3 ˚C ± 1˚C. It turns out that this much of an increase in the mean surface temperature is very significant and is in fact greater than any naturally occurring in temperature during the past 10,000 years.

There is strong evidence that the concentration of carbon dioxide is inexorably increasing in the atmosphere as the result of human activities, such as burning fossil fuels and cutting forests. Earth's climate may be warming, and extremely serious consequences may result: glaciers may melt, sea levels may rise, and agricultural production may be affected, and ecosystems may undergo substantial systems.

Earth's atmosphere and biosphere evolved together over time. The molecular composition of the atmosphere is the direct result of the gas exchange among the atmosphere, biosphere, lithosphere, and hydrosphere. Green plants, through photosynthesis and respiration, have had significant influence on the atmospheric concentrations of carbon dioxide, oxygen and water vapor.

We can project future rates of CO_2 released from human activities. If we assume that the burning of fossil will be the dominant source of CO_2 buildup in the atmosphere and that about 50% of the CO_2 produced will remain in the atmosphere, then estimates of future fossil fuel use will give estimates of the atmospheric CO_2 levels.

To project future climate conditions, it is important to understand the conditions of the past. If human activities are imposing factors for climate change on naturally occurring factors, it is essential that past relationships between cause and effect be understood. If doubling of the atmospheric carbon dioxide concentration is expected to increase the mean global temperature by 3 ˚C, it is crucial to understand whether this is a large temperature change or a small one. We can gain this perspective by considering the temperature changes of the past.

Interfere in any way with the stream of radiation from the sun to Earth's surface or with reradiation from the surface to other space and the temperature of the atmosphere, surface and oceans will change. Increase the dust load of the atmosphere and more incoming sunlight will be reflected to space and Earth will cool. Increase the atmospheric concentration of carbon dioxide, ozone, methane, water vapor, or other infrared-absorbing gases and less radiation will escape to space and Earth will warm. Vary the amount of radiation emitted by the sun up or down and Earth's temperature will change up or down.

The mechanism is well established by which an increase of the atmospheric carbon dioxide concentration might affect Earth's climate, that is, the greenhouse effect. Knowledge concerning this mechanism indicates that an increase of the carbon dioxide concentration will produce a warming of Earth's surface and lower atmosphere.

Because the atmospheric carbon dioxide concentration has been increasing steadily from late in the last century to the present, we would expect its influence on climate to correlate with this trend. If its influence has been effective, then mean temperature of Earth must have been rising slowly but persistently. We would not expect the CO_2 trend to account for any of the short-term fluctuations in globally averaged climate, as we do expect from sunspots or from volcanic activities.